FIG. 1(a)

LOAD_L

LOAD_R

150

120, 130

140

110

FIG. 1(b)

X_L

LC8   y_L

x_L

LC5

y_CL   Y_L,Y_R

X_R

Calib. Pt. (C_L)

x_CL   x_CR

LC7

150

140

LC6

130

LC3

y_CR

y_R

Calib. Pt. (C_R)

120

LC2

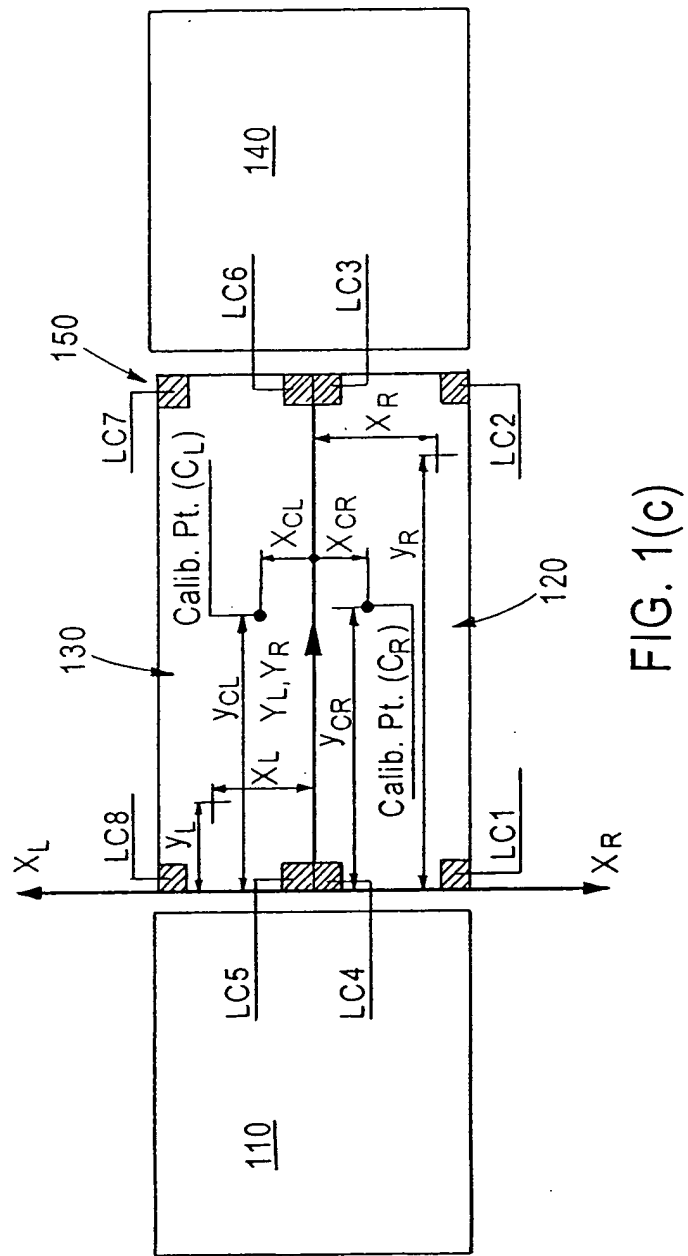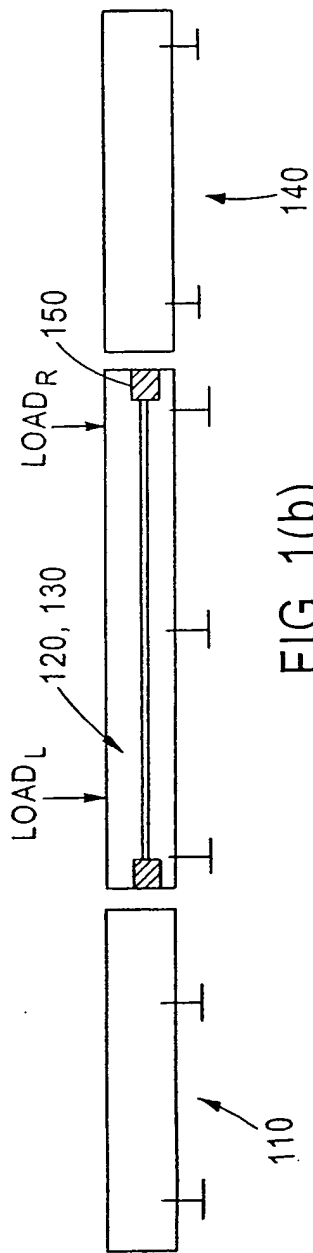LC1

110

LC4

X_R

FIG. 1(c)

Table 1. A sample of an YYMMDDxxx.ID file

Time	File running number YYMMDDxxx	Cow's Transponder	Cow's Number	Number of cows per file (n)
14:24:18	020527020	18276	199	2
14:24:18	020527020	17112	1027	
14:28:13	020527021	17212	961	4
14:28:13	020527021	17225	217	
14:28:13	020527021	18231	980	
14:28:13	020527021	15293	1026	
14:33:18	020527022	20756	991	3
14:33:18	020527022	23221	213	
14:33:18	020527022	25260	885	

Figure 2
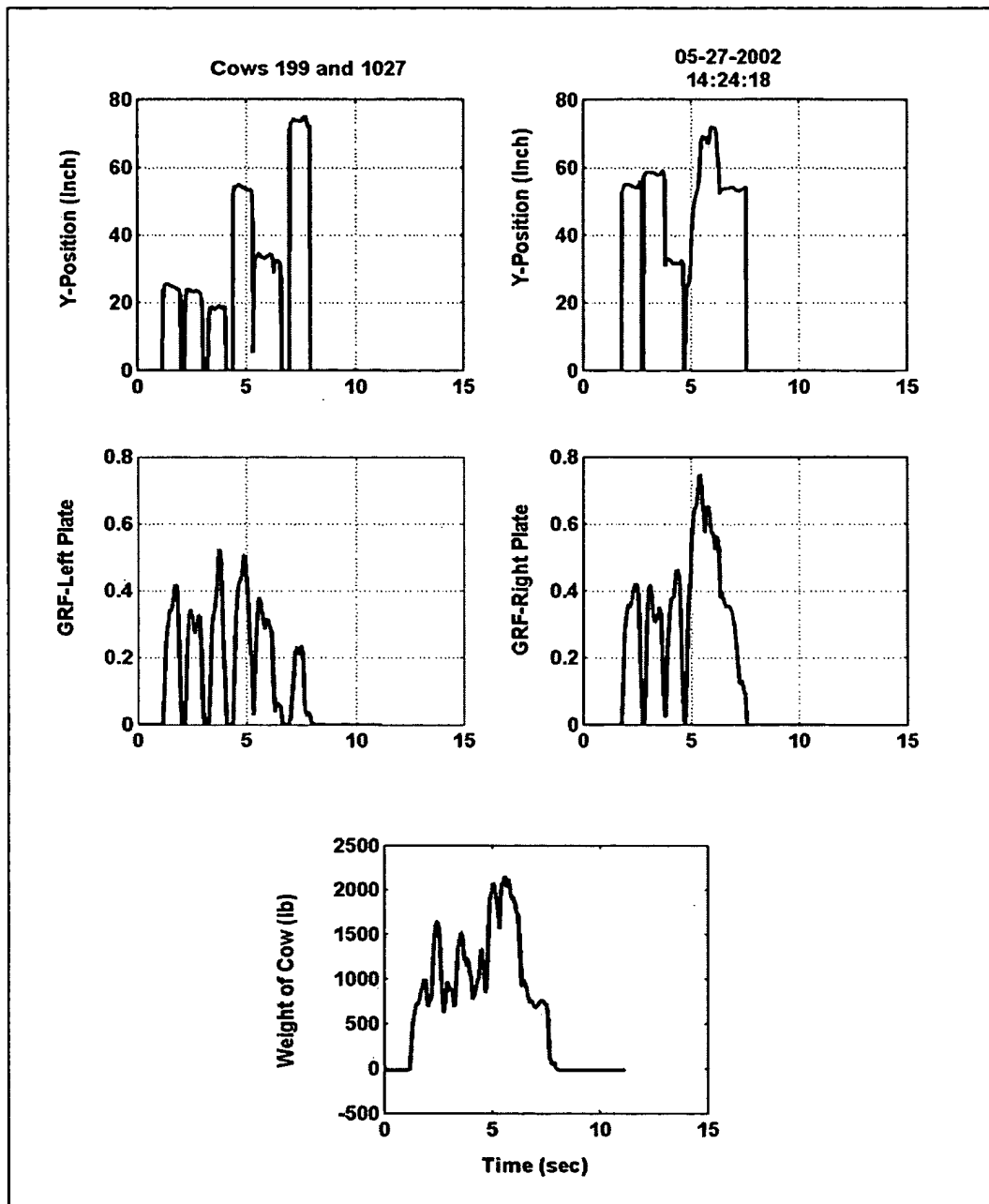
Figure 3
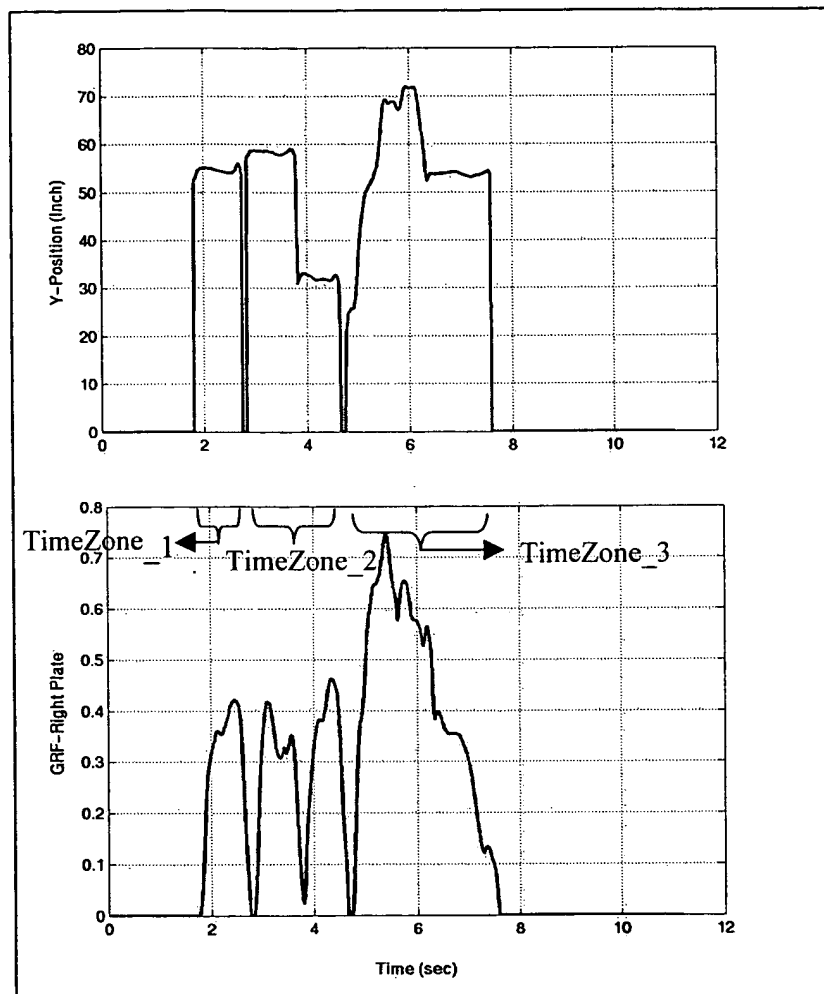
Figure 4

Table 3. Definitions of the statistical parameters evaluated in each TimeZone. The parameters are based on Y position and GRF values.

| LimbZoneStatistics	Description
Yave	Average value of Y position
Ymax	Maximum value of Y position
Ymin	Minimum value of Y position
YSLOPEmax	Maximum Y position slope
tYSLOPEmax	Time at which maximum Y position slope occurs
YSLOPEmin	Minimum Y position slope
tYSLOPEmin	Time at which minimum Y position slope occurs
PGRF	Peak Ground Reaction Force
AGRF	Average Ground Reaction Force
GRF_pos_SLOPE	Counter of positive GRF slopes
GRF_neg_SLOPE	Counter of negative GRF slopes
Delta_GRF_SLOPE	The number of times GRF changes its slope from positive to negative
J_Limb	Number of limbs in a time zone

Figure 5

Table 3. Numerical values of LimbZoneStatistics for the data plots shown in Figure 4.
TimeZone_1 reflects a single limb (J_Limb = 1), TimeZone_2 reflects 2 limbs (J_Limb
= 2), and TimeZone_3 reflects 3 limbs (J_Limb =3)

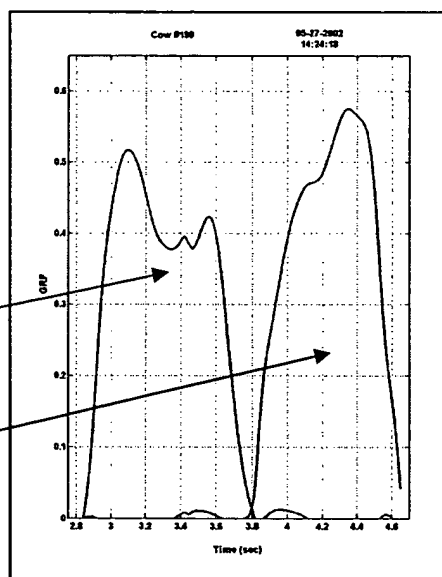| LimbZoneStatistics file 020527020	TimeZone_1	TimeZone_2	TimeZone_3
Yave	54.58	45.99	56.40
Ymax	55.05	59.10	71.91
Ymin	53.99	30.96	25.49
YSLOPEmax	0.98	2.10	14.28
tYSLOPEmax	2.54	3.82	4.97
YSLOPEmin	-0.36	-28.03	-10.56
tYSLOPEmin	2.18	3.72	6.23
PGRF	0.42	0.46	0.75
AGRF	0.36	0.32	0.46
GRF_pos_SLOPE	0	1	73
GRF_neg_SLOPE	0	14	26
DeltaGRF_SLOPE	3	7	9
J_Limb	1	2	3
LimbSequence	F	-	-

Figure 6
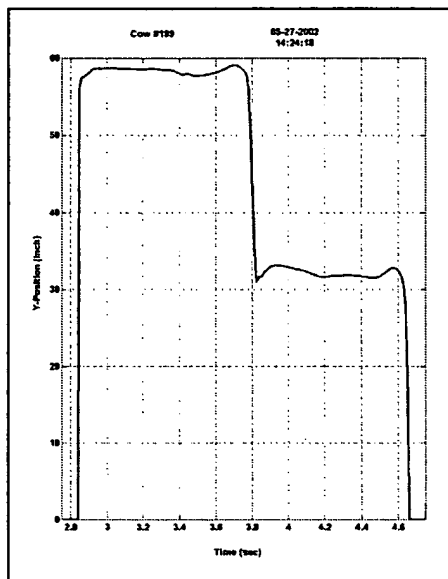
Figure 7(a)
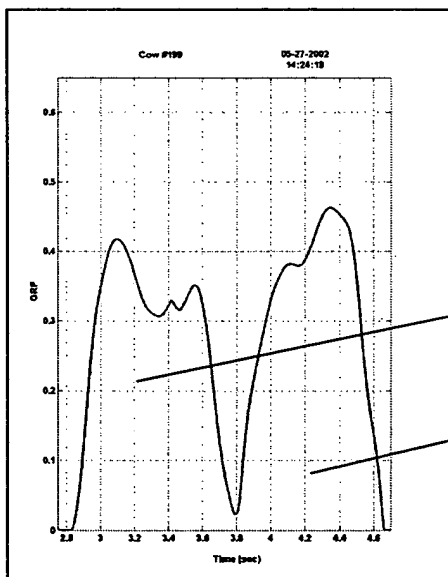
Figure 7(b)

Figure 7(c)

LimbZoneStatistics for file 020527020 (n=2)	1st Animal Cow 199		(n-1) animals Cow 1027	
	Time Zone_1	Time Zone_21	Time Zone_22	Time Zone_3
Yave	54.58	58.40	32.14	56.40
Ymax	55.05	58.40	32.14	71.91
Ymin	53.99	58.40	32.14	25.49
YSLOPEmax	0.98	0.73	1.01	14.28
tYSLOPEmax	2.54	3.55	4.45	4.97
YSLOPEmin	-0.36	-0.63	-0.82	-10.56
tYSLOPEmin	2.18	3.32	4.06	6.23
PGRF	0.42	0.42	0.47	0.75
AGRF	0.36	0.35	0.39	0.46
GRF_pos_SLOPE	0	0	0	73
GRF_neg_SLOPE	0	0	0	26
DeltaGRF_SLOPE	3	5	1	9
J_Limb	1	1	1	3
LimbSequence	F	H	F	-

Table 4: TimeZone_2 (Table 3) is a two limb zone (J_Limb=2) and the TwoLimbSeparation function is called to convert TimeZone2 into TimeZone_21 and 22. The limb zone statistics are calculated for the two separated time zones and the LimbSequence
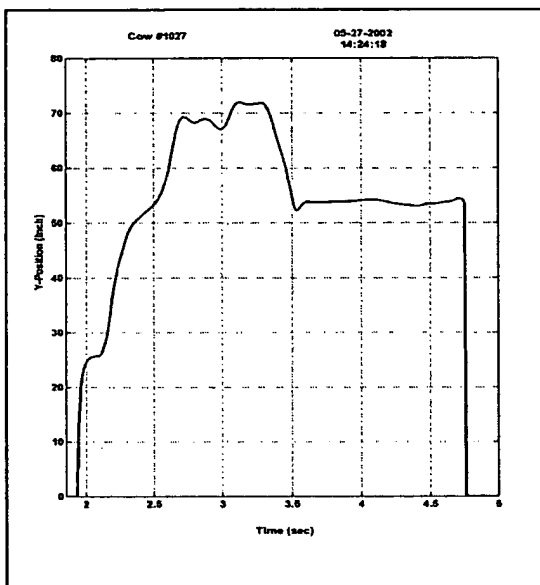
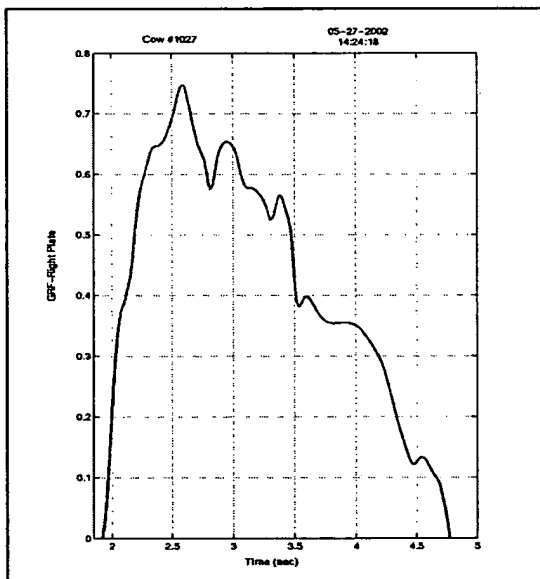## *Figure 8*
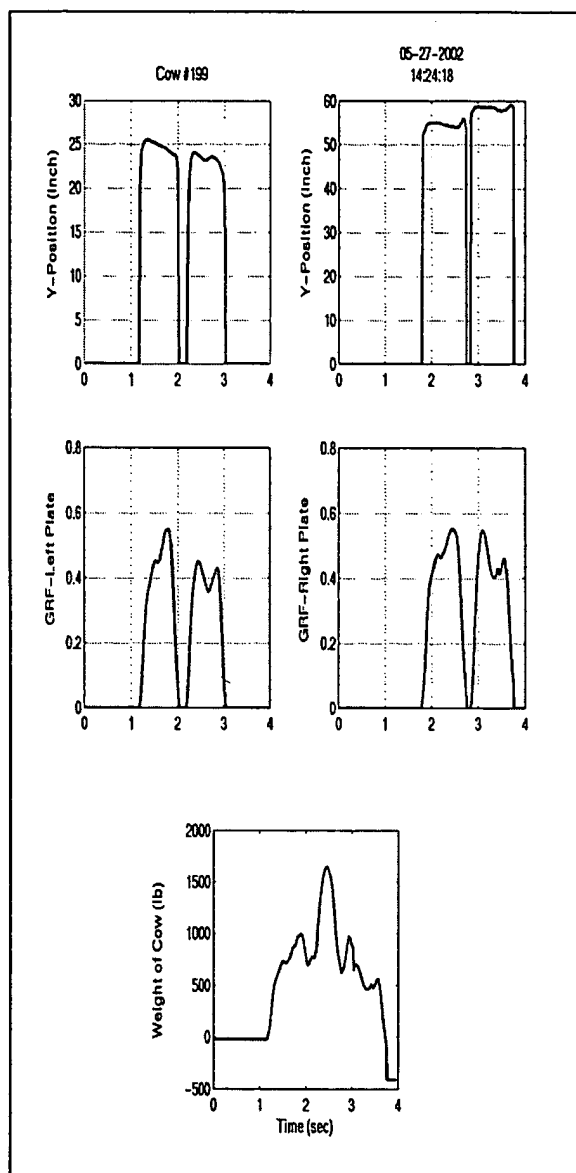
Figure 9(a)
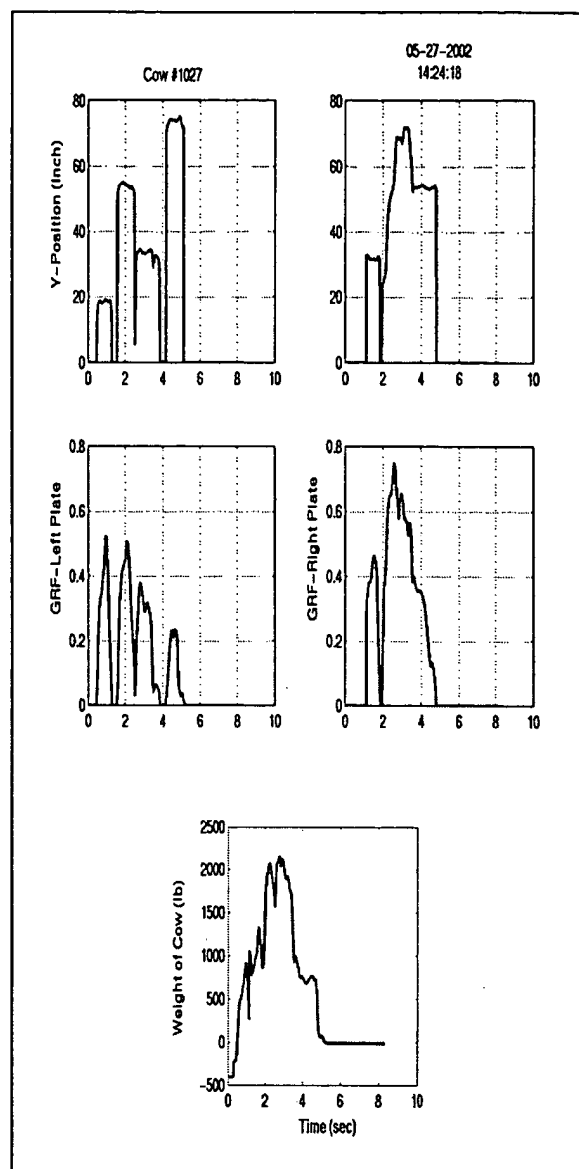
Figure 9(b)

Figure 10(a)

Figure 10(b)
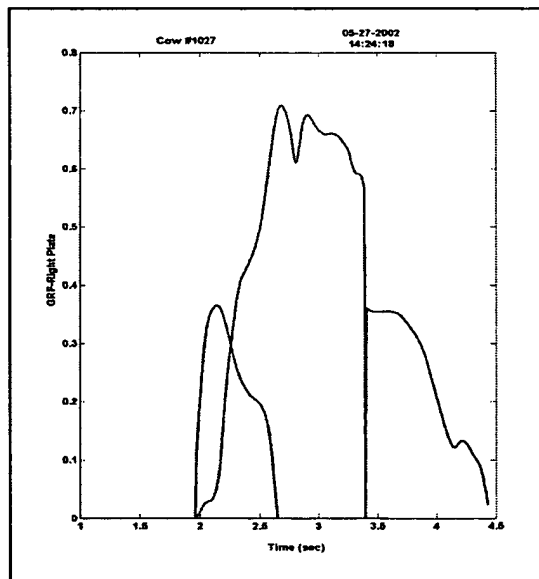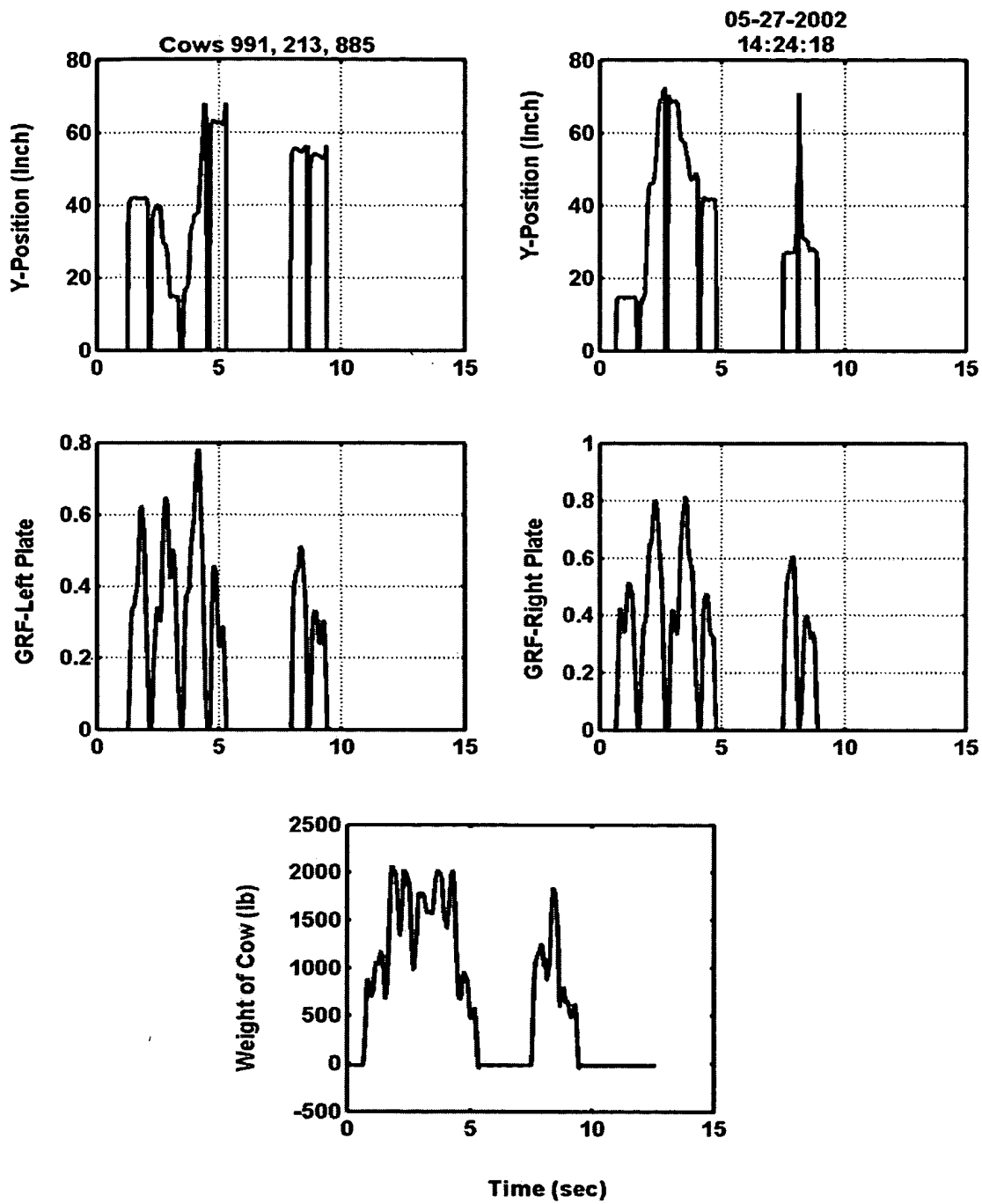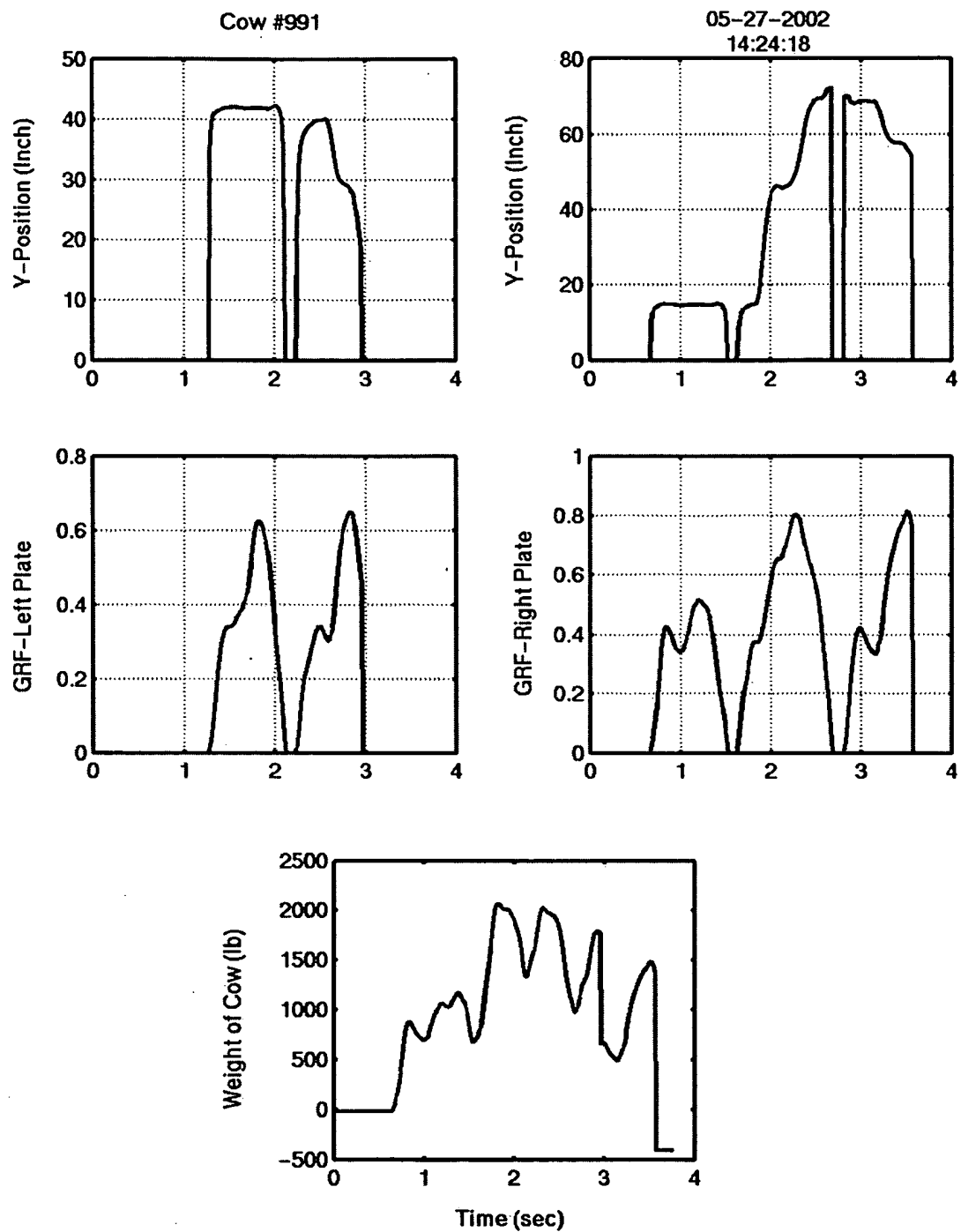

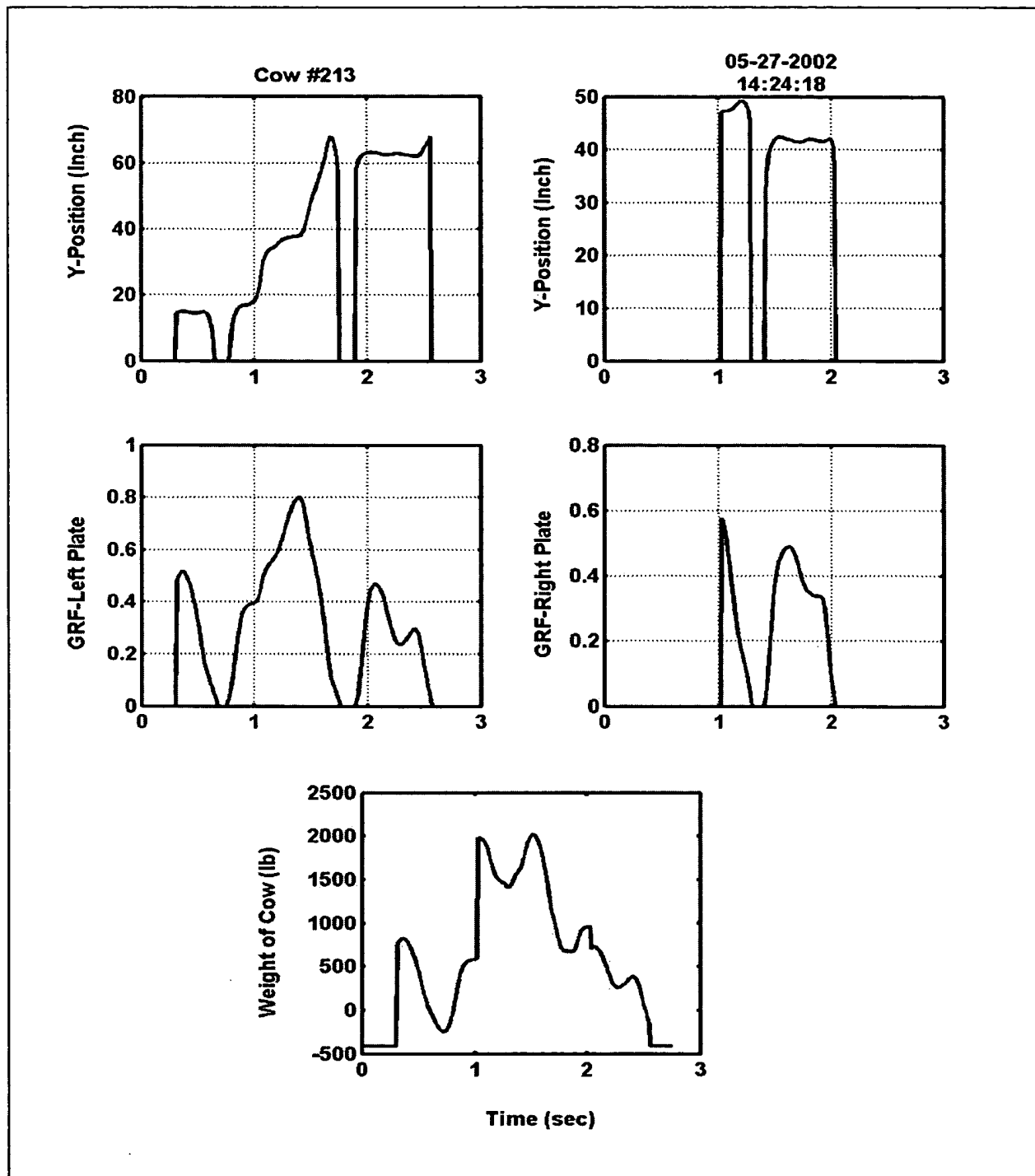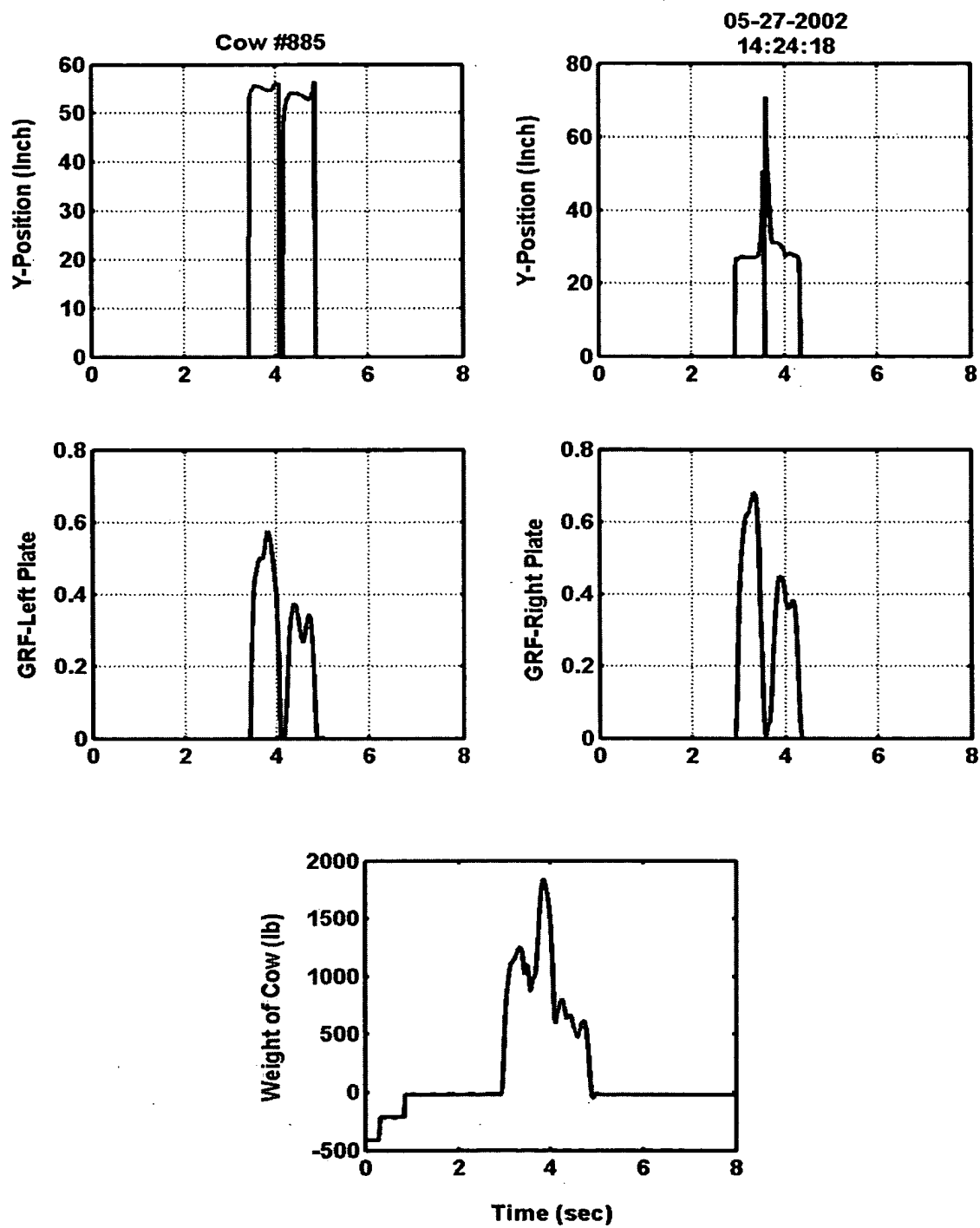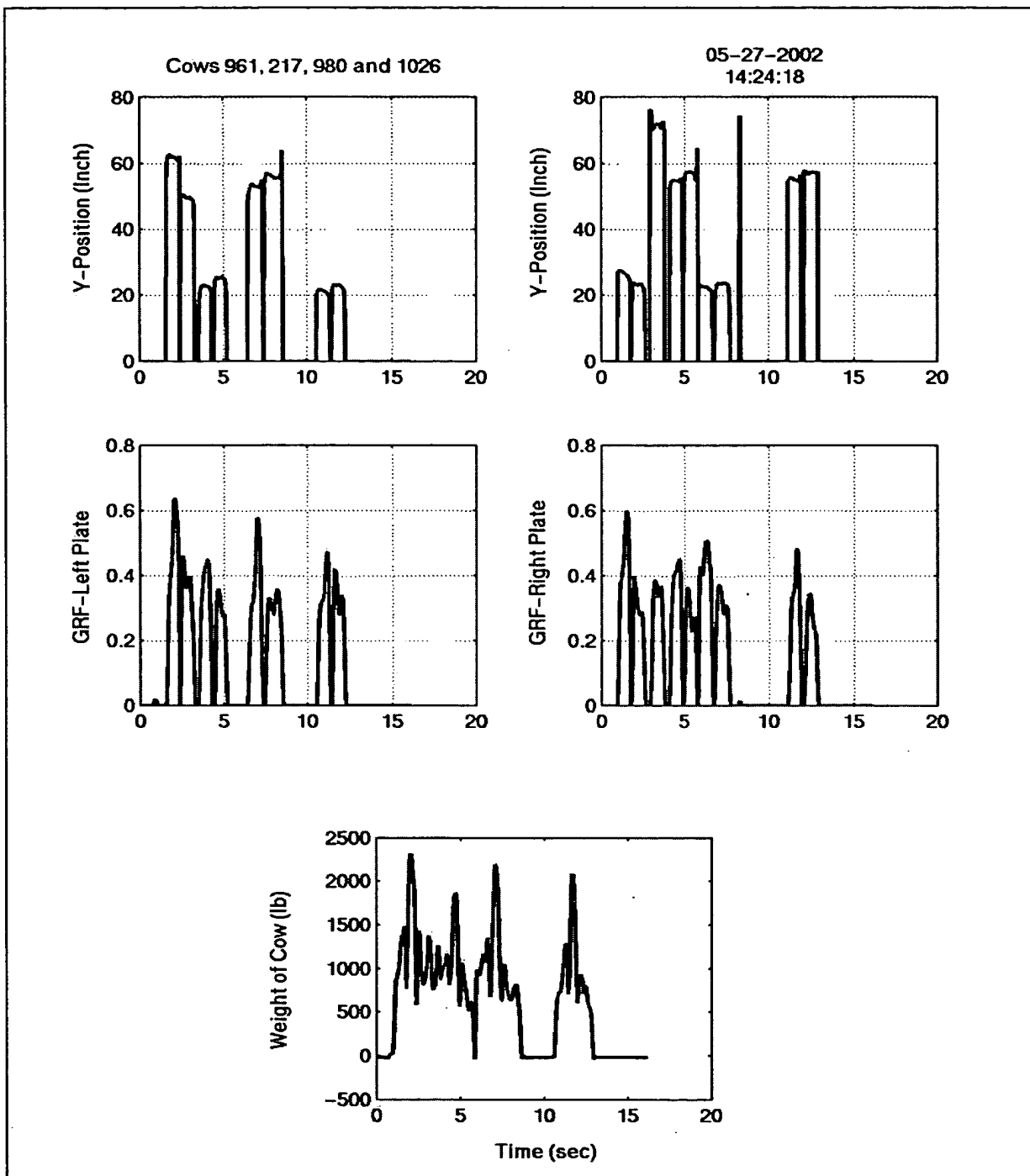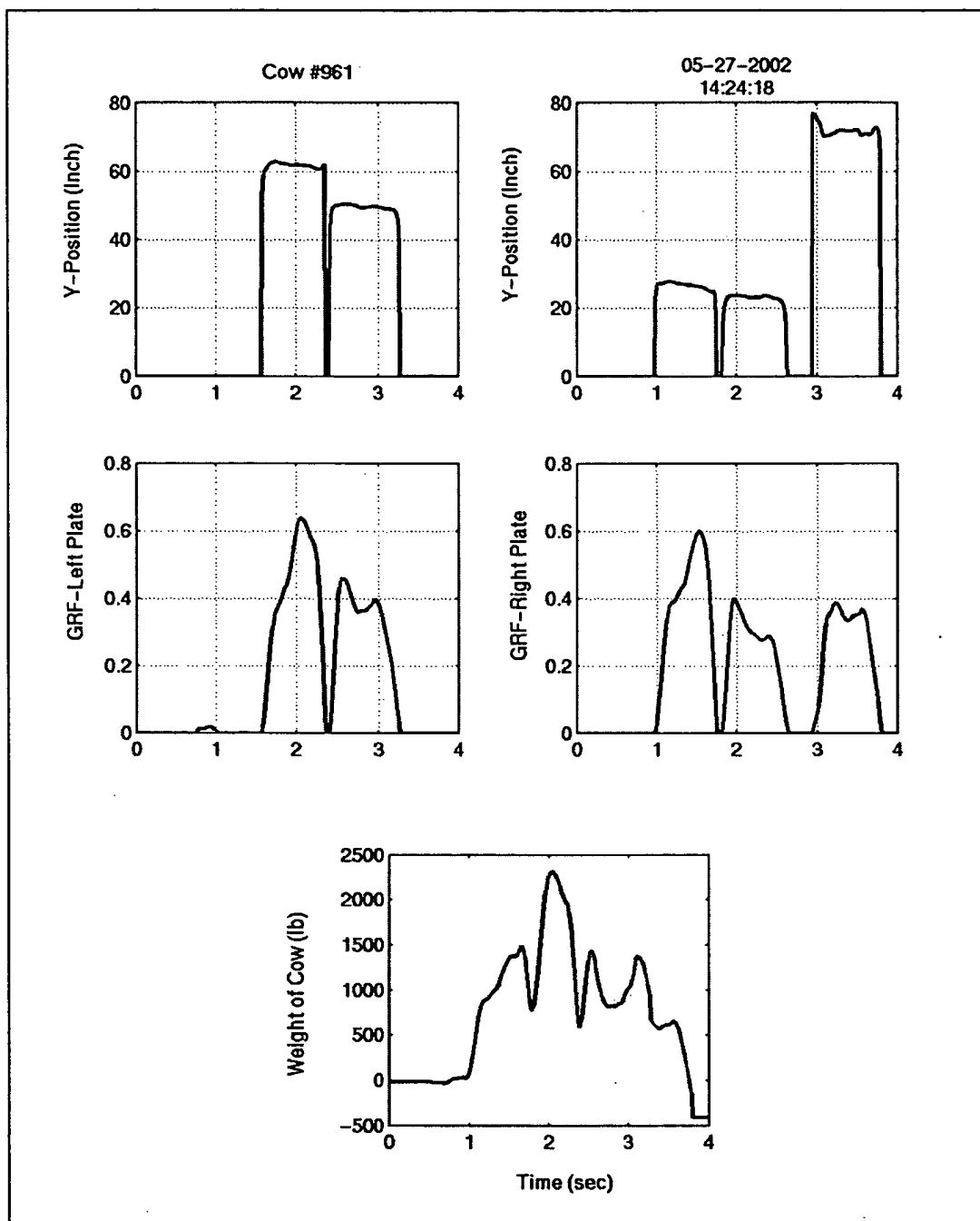
Figure 10(c)
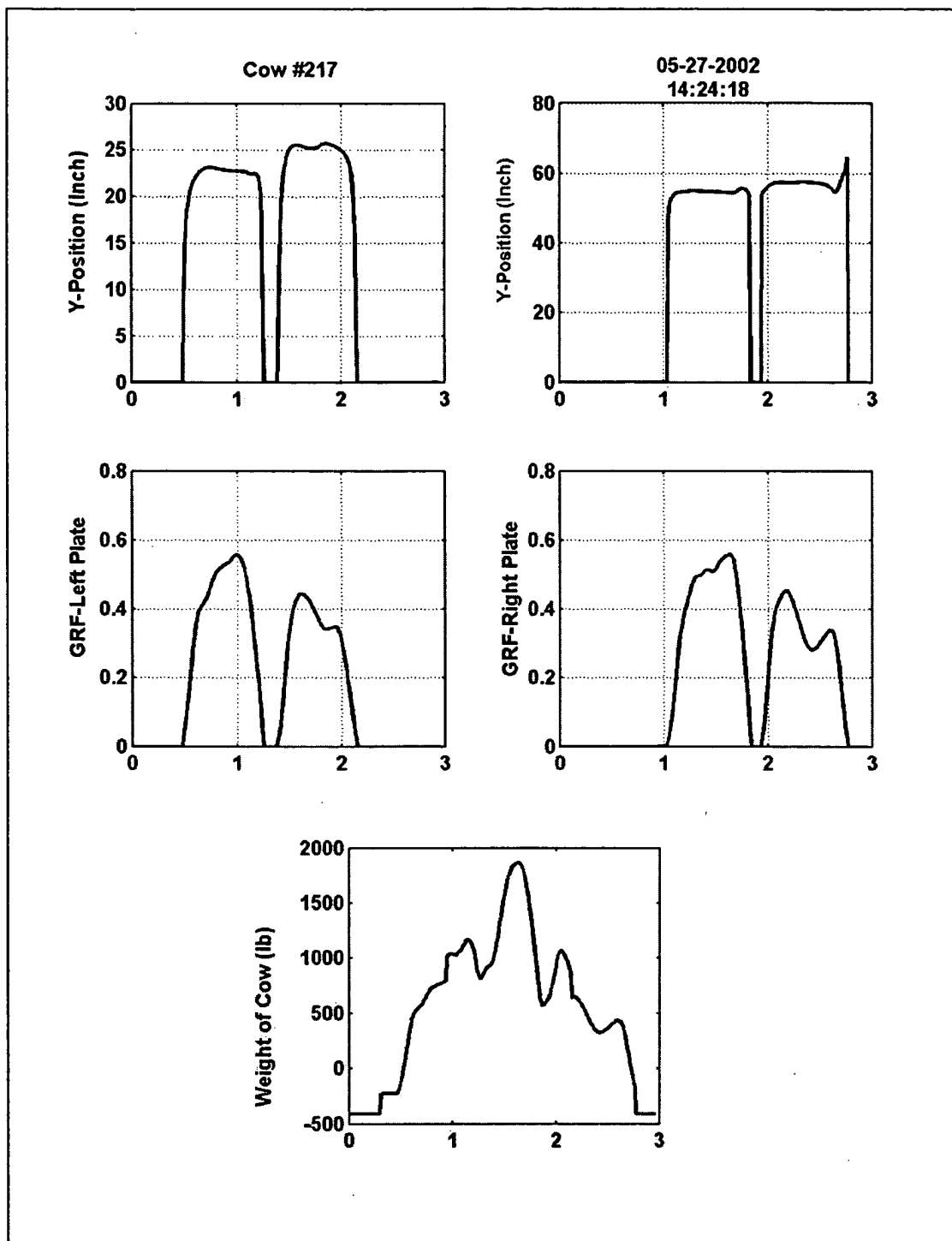
Figure 11(a)
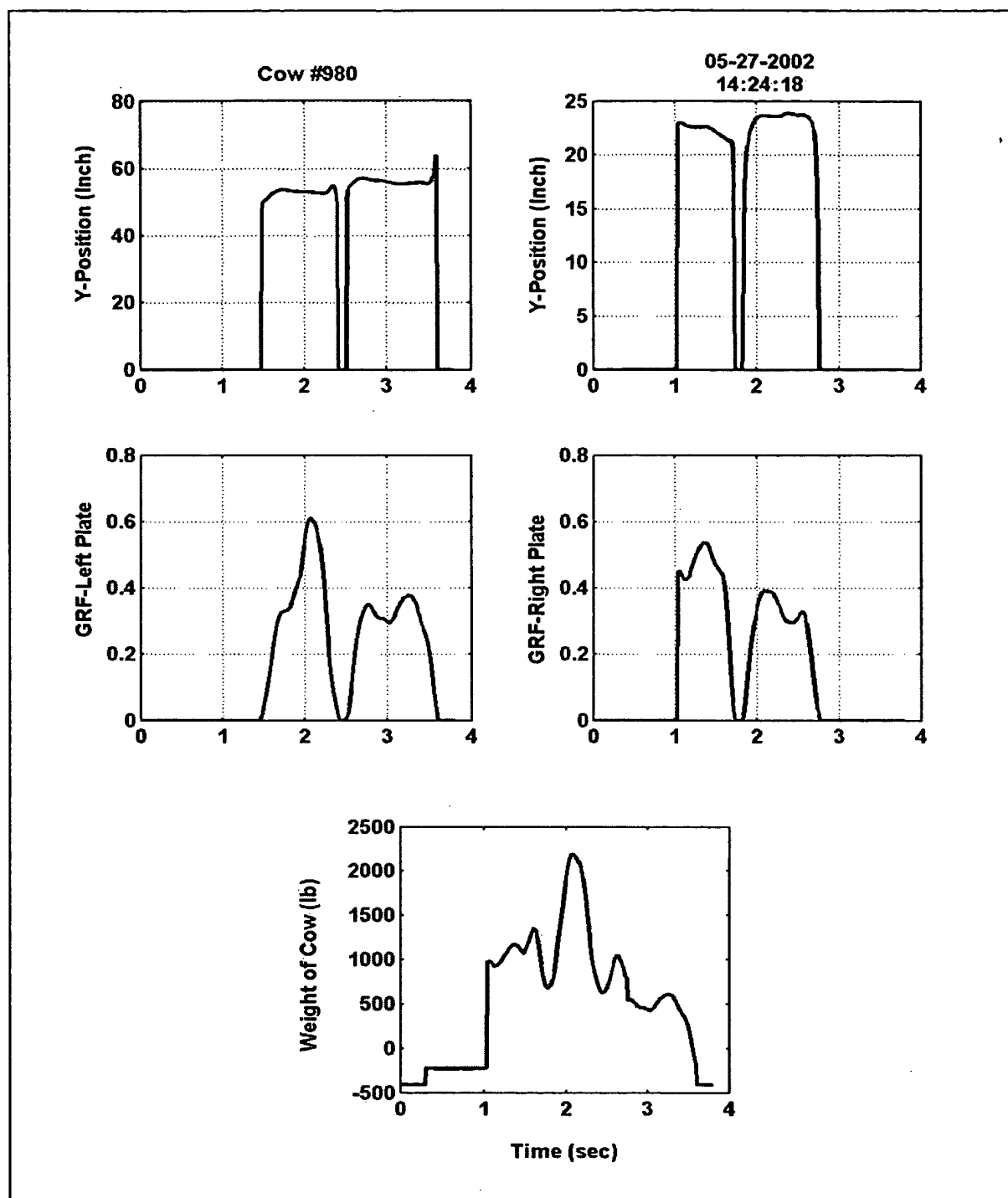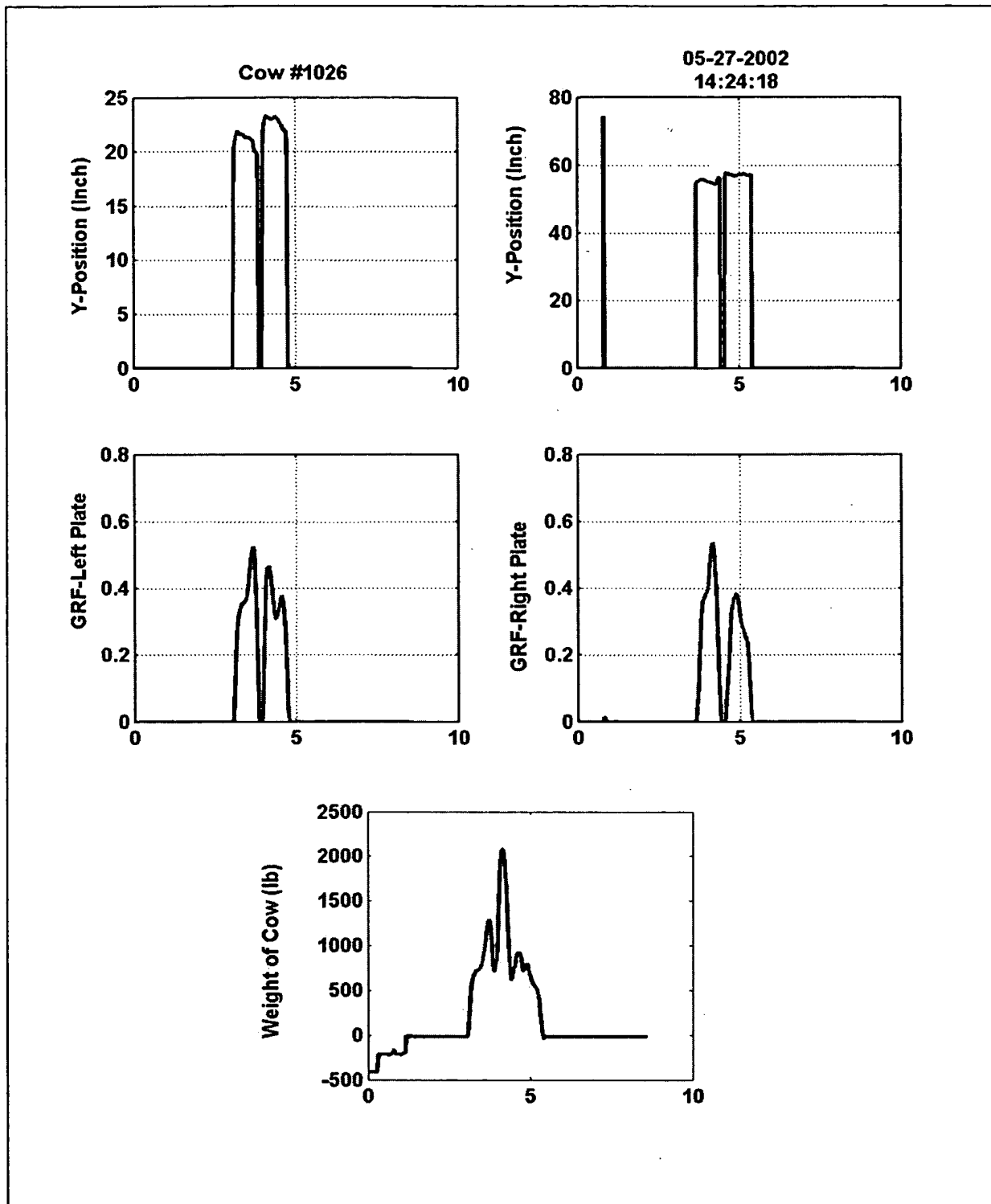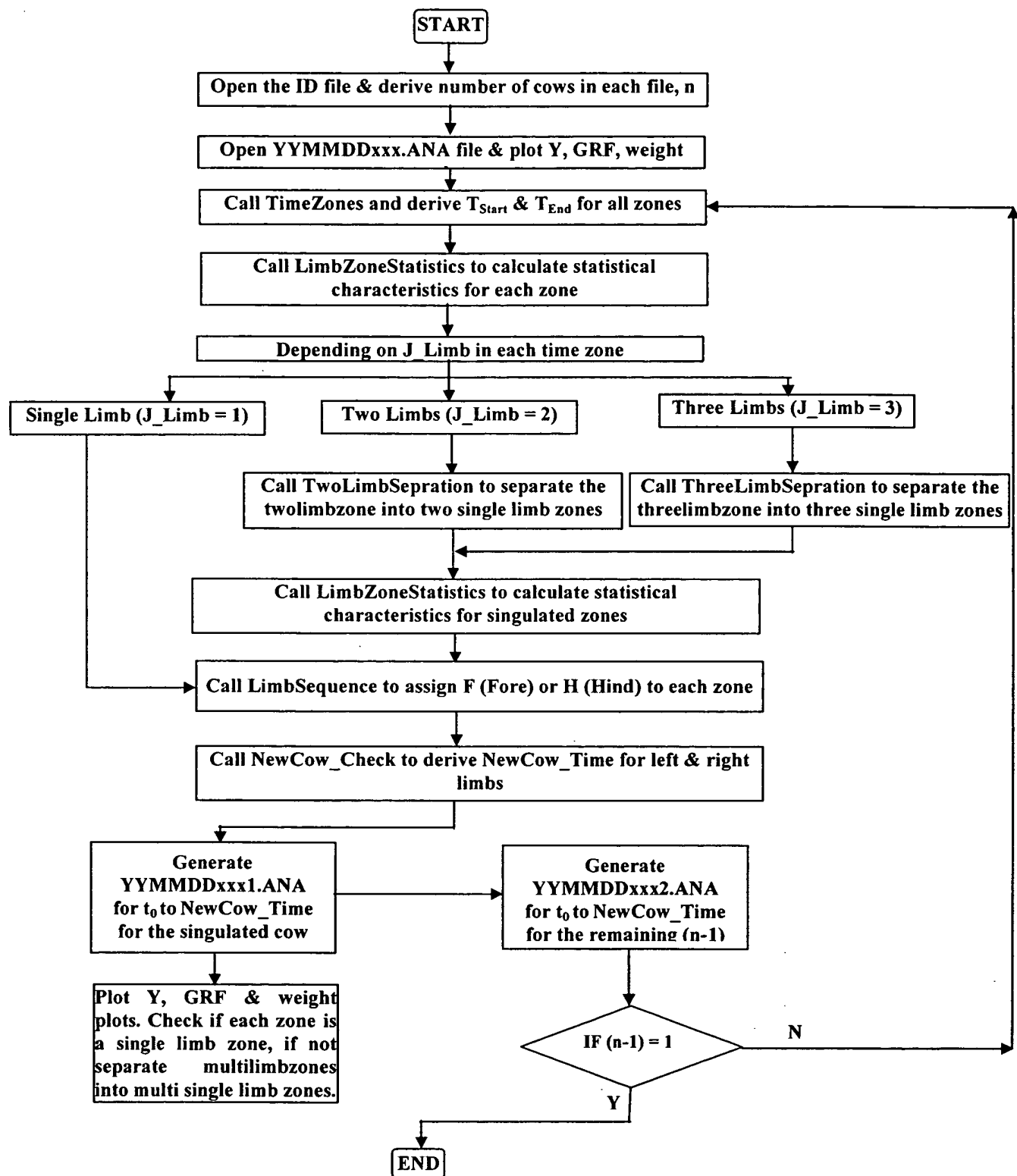
Figure 11(b)

Figure 11(c)

Figure 11(d)

Figure 12(a)

Figure 12(b)

Figure 12(c)

Figure 12(d)

Figure 12(e)

START

Open the ID file & derive number of cows in each file, n

Open YYMMDDxxx.ANA file & plot Y, GRF, weight

Call TimeZones and derive T_{Start} & T_{End} for all zones

Call LimbZoneStatistics to calculate statistical characteristics for each zone

Depending on J_Limb in each time zone

Single Limb (J_Limb = 1)   Two Limbs (J_Limb = 2)   Three Limbs (J_Limb = 3)

Call TwoLimbSepration to separate the twolimbzone into two single limb zones

Call ThreeLimbSepration to separate the threelimbzone into three single limb zones

Call LimbZoneStatistics to calculate statistical characteristics for singulated zones

Call LimbSequence to assign F (Fore) or H (Hind) to each zone

Call NewCow_Check to derive NewCow_Time for left & right limbs

Generate YYMMDDxxx1.ANA for t_0 to NewCow_Time for the singulated cow

Generate YYMMDDxxx2.ANA for t_0 to NewCow_Time for the remaining (n-1)

Plot Y, GRF & weight plots. Check if each zone is a single limb zone, if not separate multilimbzones into multi single limb zones.

IF (n-1) = 1   N

Y

END

Figure 13